

Conference

Report of the 2017 Protistology-UK Spring Meeting

The *Protistology-UK* 2017 spring meeting was organised as part of the 2017 Annual Meeting of the Microbiology Society in Edinburgh between the 3rd to the 6th of April 2017. The meeting was held at the Edinburgh International Conference Centre (EICC) and *Protistology-UK* was responsible for two sessions (three days in total), which were organised mainly by Anastasios Tsaousis (University of Kent, UK) and Sonja Rueckert (Edinburgh Napier University, UK) with the support from David Bass (Cefas and Natural History Museum of London, UK) and David Montagnes (University of Liverpool, UK). There were between 60 to 150 scientists and graduate students in attendance throughout the sessions; not only protistologists, but also microbiologists, from various backgrounds, interested in protistological research. The meeting was divided into two sessions: the first session, which was held on the 3rd of April, was focused on “Intracellular infection and endosymbiosis within protists” and the second session, which was held on the 4th and 5th of April, was dedicated to Aquatic Microbiology, especially “New model organisms and new challenges”. The sessions were chaired by Anastasios Tsaousis, Sonja Rueckert, David Bass, Jackie Parry (Lancaster University, UK), Christopher Lane (University of Rhode Island, USA), David Montagnes and John Dolan (CNRS, France). We are grateful to the support by the *Microbiology Society*, enabling us to invite six speakers from North America, six from Europe and twelve from the United Kingdom. In addition, the sessions were sponsored by the Gordon and Betty Moore Foundation, which provided support for some of the invited speakers and travel grants to the graduate students that have attended the conference and presented posters.

The first session was opened by David Bass, the current president of the *Protistology-UK* society, who introduced the society, its members and what it stands for. He continued with a short overview of his current projects including his work on microsporidian parasites and protists in soil samples in different neotropical rainforests. Ewa Nowack from Heinrich Heine University Duesseldorf gave a great presentation on the photosynthetic amoeba *Paulinella*, as a model system for studying the evolution of phototrophy and the trypanosomatid *Angomonas*, both of which provide insights into

the molecular mechanisms that underlie host-endosymbiont interactions. The session continued with a talk from William H. Lewis of Martin Embley’s group in Newcastle University (UK), who introduced genomic and transcriptomics studies on various anaerobic ciliates and an attempt to elucidate the biochemical roles and associations of their obligate endosymbionts with the hydrogenosomes (mitochondrion-related organelles in anaerobic ciliates). Afterwards, Laure Guillou from CNRS-Station Biologique de Roscoff in France talked about potential hijacking of the host plastids by *Amoebophrya* spp., an intracellular parasitoid of microalgae and thus its control of the host’s cellular functions. The last presentation of the morning session was given by Yousef Abu Kwaik from the University of Louisville (USA) who presented his work on manipulation of mammalian and amoeba cellular progresses by the AnkB effector of *Legionella pneumophila*.

The afternoon session began with an offered talk by Richard Dorrell (Ecole Normale Supérieure, France) on reconstruction of an ancient plastid proteome, which could reveal the origin and fate of complex plastid lineages. He proposed unknown serial endosymbiosis events deep in the eukaryotic evolutionary history. Then, Chris Lowe from the University of Exeter (UK) discussed the cost/benefits of endosymbiosis, using *Paramecium* as the model of his studies. He concluded that control exploitation is an important evolutionary pathway towards stable endosymbiosis. Before the afternoon coffee/tea break, Jean-Michel Claverie from CNRS Aix-Marseille University (France) introduced us to the amazing world of giant viruses as endosymbionts of marine protists. These giant viruses exhibit markedly different virion structures and replication strategies, have a very high “alien” gene content and the origin of the “pan-genome” remains a mystery.

The second part of the session was kicked off by Martina Schrällhammer from the University of Freiburg (Germany). Her offered oral presentation gave insights into the gene expression of *Paramecium tetraurelia* affected by the bacterial endosymbiont *Caedibacter taeniospiralis*. Another offered oral was given by Georgia Ward from the Natural History Museum of London (UK), who presented her work on utilizing lineage-specific molecular probing to elucidate the life-cycles of various bivalve parasites. Bryony

Williams from the University of Exeter (UK) took a short break from her maternity leave to present the bizarre world of microsporidia using environmental sampling to identify novel lineages. Bryony is exploring the diversity of these parasites, since microsporidia frequently emerge as pathogens of economically important animals fostered by stress and immunosuppression. Final speaker of this session and the day was John Archibald from Dalhousie University (Halifax, Canada). He demonstrated a multidisciplinary approach that his laboratory and collaborators have developed to investigate the symbiotic relationship between *Paramoeba pemaquidensis* and its endosymbiont *Perkinsella* sp. This work will provide insights into understanding the determinants of pathogenicity in the economically important host. After the talks, the participants of the session along with members and friends of *Protistology-UK*, headed to the “Voodoo Rooms” restaurant for a traditional Scottish dinner experience.

Day two of the meeting initiated the second 2-day symposium on Aquatic Microbiology, focused on new model organisms and new challenges. The symposium started with a speech from Jon Kaye, Program Director of the Marine Microbiology Initiative of the Gordon and Betty Moore Foundation, who gave an introduction to the Foundation and the different awards/grants that it is offering. He also discussed the new challenges that the Marine Microbiology Initiative is facing, to develop new concepts and technologies to understand microbial communities in the sea and their influence on ocean ecosystems and the planet. The Moore Foundation did not only sponsor this session, but most of the speakers of the meeting received significant financial support to develop the technologies that were presented during this meeting. After the introduction of this session by Jon Kaye, Thomas Mock from the University of East Anglia in UK presented the second talk of the day. His talk was focused on new developments, challenges and opportunities of genome editing in the two diatoms *Thalassiosira pseudonana* and *Fragilariopsis cylindrus*. Thomas provided some new insights and tips in the development of knock-out transformations and clustered regularly interspaced short palindromic repeats (CRISPR/Cas9) systems in both organisms. After the morning break, it was the turn of Angela Falciatore from the Université Pierre et Marie Curie (France) to talk about the functional genomic approaches to understand diatom biology, using *Phaeodactylum tricorutum* as a model. Like the previous speaker, she discussed the challenges of working with these organisms and provided tips in developing gene editing using both transcription activator-like effector nucleases (TALENs) and CRISPR/Cas9 systems for this diatom. Christopher Lane from the University of Rhode Island (USA), changed the atmosphere by giving an entertaining talk on using a series of genomics approaches to elucidate the relationship between the marine apicomplexan *Nephromyces*, its bacterial symbionts and its tunicate host. This work will provide insights into the metabolic pathways that enabled this parasite genus to become endosym-

bionts. The morning session was concluded with two offered orals: Michael Cunliffe from the Marine Biological Association of the UK (Plymouth, UK) discussed the algal polysaccharide utilisation by saprotrophic planktonic marine fungi and the potential influence into the biology and ecology these organisms and Maria Rubio-Brotons from the Institute of Evolutionary Biology (CSIC-UPF, Spain) discussed her exciting results on developing a novel transfection system for the unicellular opisthokont *Corallochytrium limacisporum*, to understand the evolution of multicellularity.

The afternoon session began with a presentation from Anastasios Tsousis who discussed the different approaches that his laboratory has taken into developing a successful transfection system for *Naegleria gruberi*. In addition, he presented results from both proteomic and immunolocalisation studies in an attempt to characterize biochemical mitochondrial pathways and explore the membrane trafficking system of this peculiar excavate. Julius Lukês from the University of South Bohemia (Ceske Budejovice, Czech Republic) introduced us to diplomonids, the enigmatic group of unicellular eukaryotes that according to the recent surveys may be widespread in marine ecosystems. He discussed the diversity of these organisms, the unprecedented abundance of their mitochondrial genomes and the challenges that were faced on developing a transfection system for them. Before the afternoon break, Tomislav Ivankovic from the University of Zagreb (Croatia) gave an offered oral presentation on the abundance of carbapenem-resistant bacteria *Acinetobacter baumannii* in a wastewater treatment plant in the Croatian capital city. He showed that only alkaline disinfection by lime treatment prevented the spreading of these bacteria.

Ross Waller from the University of Cambridge (UK) kicked off the last session of the day with a presentation on newly developed tools for genetic manipulation of the dinoflagellate *Perkinsus marinus* along with some interesting characteristics of their “bizarre” cell biology. These newly developed tools can now be utilized to explore the biology of other dinoflagellates. Next, Sarah Heath from the University of Edinburgh (UK) had an offered oral presentation on the environmental effects on host-virus interactions in the marine (picoeukaryote) algae *Ostreococcus tauri*. Last presentation of the day came from Virginia Edgcomb from the Woods Hole Oceanographic Institution (USA). Ginny presented a series of newly developed high throughput microfluidic transfection protocols for the marine protists *Parabodo* and *Monosiga* and compared their efficiency and outcomes to standard technologies. Her presentation initiated an interesting discussion on these technologies at the end of the session. After the talks, the participants of this session gathered at the Usquabae Whisky Bar & Larder to tickle their taste buds with traditional Scottish cuisine and whisky.

The final day of the meeting and the second day within the Aquatic microbiology session was dedicated to the diversity, ecology and evolution of various organisms to further our

understanding of their complexity and relationships within aquatic ecosystems. The morning session was off to a good start with John Dolan presenting his work on diversity patterns of marine microbes using tintinnid ciliates as model organisms. He touched widely discussed hot topics, such as climate change, invasive species and rare species and urged the audience to not forget about the old literature and existing species records, when studying biodiversity. Sonja Rueckert continued with a glimpse into the diversity of gregarine apicomplexans infecting deep-sea invertebrates that were collected on a research cruise around the UK and Ireland. She emphasized that while some environmental SSU rDNA sequences have been shown to belong to gregarine lineages, no gregarine species has been described on a morphological or ultrastructural level from the deep-sea yet. David Montagnes talked about one of the most important relationships (temperature and biological rate) in physical chemistry, the Arrhenius equation $k = Ae^{-E_a/RT}$ and its relevance/correctness in microbial ecology. In his provocative talk he discussed how biological systems deviate from Arrhenius' assumptions to spur further research in this area. After the coffee break Joseph Christie-Oleza (University of Warwick, UK) explained how important nutrient recycling is for a stable and interactive relationship of phototrophs and heterotrophs in marine systems in his offered oral presentation. We learned that in culture, for example, heterotrophs avoid the build up of photosynthates, which can become toxic for phototrophs, by re-mineralization of leaked organic matter. The second offered oral was by Manon Duret (University of Southampton, UK) on sinking marine snow. She observed different microbial particles associated with either sinking or suspended particles. These differences suggest a niche separation based on different organic matter labilities and subsequent imposed lifestyle. Susanne Menden-Deuer from the University of Rhode Island (USA) finished the morning session questioning: 'Is a plankton a plankton a plankton?'. She presented her research uncovering the drivers of phytoplankton production, which is varying in space and time and the role protistan predator-prey relationships might play.

The afternoon session started with a timely presentation on environmental impact assessments (EIA) of salmon aquaculture by Thorsten Stoeck from the University of Kaiserslautern, (Germany). For this study, he utilized DNA barcoding (V9 region of SSU rDNA gene) of ciliates from samples obtained underneath and at distances from the salmon farm in order to determine the level of pollution. He also discussed indicator qualities that need to be fulfilled and potential indicator organisms for EIA. Julie Robidart (National Oceanography Centre, UK) presented the use of biosensors to study the annual bloom in the North Pacific. She revealed that metatranscriptomics from endemic microbial communities can be clear indicators of recent upwelling events, which are thought to be responsible for the input of nutrients in the nitrogen limited Pacific. Arwyn Edwards from Aberystwyth University (UK) gave an overview on glaciers,

their importance, and their fast decline, before presenting his work on the microbial communities associated with them. Glacier ice surfaces represent seasonally-evolving, three dimensional microbial habitats as solar radiation penetrates the ice surface, and there is urgent need to explore these habitats, before they disappear. After a short break Cédric Berney (UPMC & CNRS – Station Biologique, France) presented an offered oral on UniEuk: a universal taxonomic framework and integrated reference gene databases to synergise research in eukaryotic biology, ecology and evolution. This international collaborative project, which is supported by the Moore Foundation, will be holding a third UniEuk workshop in March 2018, in Roscoff (www.unieuk.org). The second offered oral was given by Adam Wyness from the University of St Andrews (UK) on 'The role of cell and particle characteristics in the adhesion of *E. coli* to suspended intertidal sediments'. He talked about the importance for wastewater treatment plants to understand these characteristics (e.g. zeta potential of cell/particle charge) in different strains of faecal indicator organisms. Despo Polyviou (University of Southampton, UK) presented the last offered oral connecting the deserts with the oceans via dust particles. She presented her work on the interactions of a cyanobacterium (*Trichodesmium*) with the dust particles, a major source of limited iron in the oceans. The final day of the Protistology-UK meeting ended with a fascinating talk by Alexandra Worden from the Monterey Bay Aquarium Research Institute (USA) about picoeukaryotes, the smallest free living eukaryotic cells in marine systems. These tiny unicellular organisms are widely distributed in the oceans and she presented ways to unravel their significant ecological roles, e.g. in the carbon cycle.

In addition to the oral presentations, there were numerous poster presentations associated with the two sessions organised by *Protistology-UK*. Poster presenters received travel awards from either *Protistology-UK/Moore Foundation* or the *Microbiology Society*. A handful of the presenters were nominated for Young Microbiologist of the Year 2017 award by the *Microbiology Society*. The poster session was a great opportunity for postgraduate students and early-career post-doctoral fellows to present their work on various protists and interact with other participants of the *Microbiology Society* meeting. During this meeting the *Microbiology Society* also organised numerous network and training activities for postgraduate student and early career researchers, including sessions on scientific publishing (writing a manuscript for submission and reviewing scientific manuscripts) and a professional development session on finding a suitable post-PhD career. The *Protistology-UK* meeting concluded with final remarks and acknowledgments to the organisers and sponsors from Anastasios Tsaousis (current meeting coordinator of *Protistology-UK*). He also announced the 2018 meeting of the *International Society of Evolutionary Protistology (ISEP)* that will take place in Cyprus between 27th of May until the 1st of June 2018. We are happy to announce that the 2018 *Protistology-UK* spring meeting will be held

as part of the ISEP2018 conference (Droushia, Cyprus; www.isep18.com).

Sonja Rueckert^{a,*}

Anastasios D. Tsaousis^b

^a School of Applied Sciences, Edinburgh Napier University,
Edinburgh, UK

^b Laboratory of Molecular and Evolutionary Parasitology,
RAPID group, School of Biosciences,
University of Kent, Canterbury, UK

* Corresponding author.

E-mail address: s.rueckert@napier.ac.uk (S. Rueckert)